#### SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

#### 2102-F-21-R-42

Name: Lake Madison County: Lake Legal Description: T106-R51, 52-Sec. 21-23, 25-27, 29, 30-32 Location from nearest town: 5 miles southeast of Madison, SD

**Dates of present survey**: July 20-22, 2009 (netting); September 10, 2009 (electrofishing) **Dates of last survey**: July 21-23, 2008 (netting); September 2, 2008 (electrofishing)

Primary Game and Forage Species	Secondary and Other Species
Walleye	Spottail Shiner
Yellow Perch	Common Carp
Black Crappie	White Sucker
	Bigmouth Buffalo
	Black Bullhead
	Channel Catfish
	Northern Pike
	Green Sunfish
	Hybrid Sunfish
	Bluegill
	Smallmouth Bass

### PHYSICAL DATA

Surface area: 2,642 acres Watershed area: 29,191 acres

Maximum depth: 16 feet Mean depth: 8 feet

Volume: 27,153 acre-feet Shoreline length: 15.7 miles

Contour map available: Yes Date mapped: 2002

OHWM elevation: 1603.7 Date set: November, 1980 Outlet elevation: 1603.2 Date set: November, 1980

Lake elevation observed during the survey: Full, flowing out the outlet

**Beneficial use classifications**: (4) warmwater permanent fish life propagation, (7)

immersion recreation, (8) limited-contact recreation and (9) fish and wildlife propagation and

stock watering.

#### Introduction

Lake Madison is a natural lake, second in a chain of four lakes (Herman, Madison, Round and Brant), formed by receding glacial ice. It was named for the 1875 town of Madison, originally located on the south shore of the lake. William Van Eps, the surveyor who platted the original town, named it Madison because he thought it resembled his hometown of Madison, Wisconsin.

#### Ownership of Lake and Adjacent Lakeshore Properties

Lake Madison is listed as meandered public water in the State of South Dakota Listing of Meandered Lakes and the South Dakota Department of Game, Fish, and Parks (GFP) manages the fishery. GFP also owns and manages access areas on the south, west and north shores of the lake. The remainder of the shoreline property is privately owned.

#### **Fishing Access**

The Payne Access Area on the west side of Lake Madison has a double lane boat ramp with a dock, public toilet and excellent shore fishing access. The Johnson Point Access Area on the north side of the lake has a double wide boat ramp with a dock, public toilet, a handicapped-accessible fishing dock and excellent shore fishing access. The Stratton Access Area is located on the north shore of the lake and offers limited shore fishing opportunity. The Walker's Point Recreation Area on the south shore of the lake offers a double wide boat ramp with a dock, fish cleaning station, public toilets, and camping facilities with electric hookups as well as excellent shore fishing areas.

### Field Observations of Water Quality and Aquatic Vegetation

The Secchi depth measurement in Lake Madison this year was 1.3 m (53 in). Some sago pondweed (*Potamogeton pectinatus*) was observed during the survey.

### **BIOLOGICAL DATA**

#### Methods:

Lake Madison was sampled on July 20-22, 2009 with six overnight gill-net sets and ten overnight trap-net sets. The trap nets are constructed with 19-mm-bar-mesh ( $\frac{3}{4}$  in) netting, 0.9 m high x 1.5 m wide (3 ft high x 5 ft wide) frames and 18.3 m (60 ft) long leads. The gill nets are 45.7 m long x 1.8 m deep (150 ft long x 6 ft deep) with one 7.6 m (25 ft) panel each of 13, 19, 25, 32, 38 and 51-mm-bar-mesh ( $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1, 1 $\frac{1}{4}$ , 1 $\frac{1}{2}$ , and 2 in) monofilament netting. Two hours of nighttime electrofishing were done on September 10, 2009 to evaluate walleye recruitment. Sampling locations are displayed in Figure 4.

#### **Results and Discussion:**

# **Gill Net Catch**

Yellow perch (32.3%), white sucker (31.7%) and walleye (29.6%) were the most abundant species in the gill-net catch this year followed by black bullhead at 4.7% (Table 1). Common carp, bigmouth buffalo, black crappie, northern pike, and spottail shiner were also sampled.

**Table 1.** Total catch from six overnight gill-net sets at Lake Madison, Lake County, July 20-22, 2009.

Species	Number	Percent	CPUE <sup>1</sup>	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Yellow Perch	110	32.3	18.3	<u>+</u> 2.0	126.6	89	11	114
White Sucker	108	31.7	18.0	<u>+</u> 3.5	16.7	93	84	107
Walleye	101	29.6	16.8	<u>+</u> 4.6	16.3	15	2	89
Black Bullhead	16	4.7	2.7	<u>+</u> 0.8	6.9	88	0	104
Common Carp	2	0.6	0.3	<u>+</u> 0.3	3.2			
Bigmouth Buffalo	1	0.3	0.2	<u>+</u> 0.2	3.2			
Black Crappie	1	0.3	0.2	<u>+</u> 0.2	2.5			
Northern Pike	1	0.3	0.2	<u>+</u> 0.2	0.3			
Spottail Shiner	1	0.3	0.2	<u>+</u> 0.2	0.0			

<sup>\* 10</sup> years (1999-2008)

**Table 2**. Catch per unit effort by length category for various fish species captured with gill nets in Lake Madison, July 20-22, 2009.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Yellow Perch		18.3	2.0	14.3	2.0	18.3	<u>+</u> 2.0
White Sucker		18.0	1.3	1.5	15.2	18.0	<u>+</u> 3.5
Walleye	5.8	10.9	9.2	1.5	0.2	16.8	<u>+</u> 4.6
Black Bullhead		2.7	0.3	2.4		2.7	<u>+</u> 0.8
Common Carp		0.3		0.2	0.1	0.3	<u>+</u> 0.3
Bigmouth Buffalo		0.2	-	0.2		0.2	<u>+</u> 0.2
Black Crappie		0.2	0.2			0.2	<u>+</u> 0.2
Northern Pike		0.2			0.2	0.2	<u>+</u> 0.2
Spottail Shiner*						0.2	<u>+</u> 0.2

<sup>\*</sup>No length categories established. Length categories can be found in Appendix A.

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<sup>&</sup>lt;sup>1</sup> See Appendix A for definitions of CPUE, PSD, and mean Wr.

# **Trap Net Catch**

Bigmouth buffalo (38.8%), black bullhead (19.2%), black crappie (11.5%) and common carp (11.2%) were the most abundant species sampled in the trap nets (Table 3). Seven other species were also sampled.

**Table 3.** Total catch from ten overnight trap net sets at Lake Madison, Lake County, July 20-22, 2009.

Species	Number	Percent	CPUE	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Bigmouth Buffalo	111	38.8	11.1	+3.3	8.3	47	21	100
Black Bullhead	55	19.2	5.5	<u>+</u> 2.1	80.5	77	19	98
Black Crappie	33	11.5	3.3	<u>+</u> 1.5	15.3	97	12	109
Common Carp	32	11.2	3.2	<u>+</u> 1.5	12.3	100	25	96
Walleye	17	5.9	1.7	<u>+</u> 0.8	3.3	33	11	91
Yellow Perch	15	5.2	1.5	<u>+</u> 0.6	46.3	80	13	102
Northern Pike	12	4.2	1.2	<u>+</u> 0.6	0.4	75	25	100
White Sucker	7	2.4	0.7	<u>+</u> 0.4	17.3			
White Bass	2	0.7	0.2	<u>+</u> 0.2	0.0			
Bluegill	1	0.3	0.1	<u>+</u> 0.1	3.0			
Hybrid Sunfish	1	0.3	0.1	<u>+</u> 0.1	0.3			-

<sup>\*10</sup> years (1998-2007)

**Table 4**. Catch per unit effort by length category for various fish species captured with trap nets in Lake Madison, July 20-22, 2009.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Bigmouth Buffalo	0.1	11.0	5.8	2.9	2.3	11.1	<u>+</u> 3.3
Black Bullhead	1.2	4.3	1.0	2.5	0.8	5.5	<u>+</u> 2.1
Black Crappie		3.3	0.1	2.8	0.4	3.3	<u>+</u> 1.5
Common Carp		3.2		2.4	0.8	3.2	<u>+</u> 1.5
Walleye	0.8	0.9	0.6	0.2	0.1	1.7	<u>+</u> 0.8
Yellow Perch		1.5	0.3	1.0	0.2	1.5	<u>+</u> 0.6
Northern Pike		1.2	0.3	0.6	0.3	1.2	<u>+</u> 0.6
White Sucker		0.7		-	0.7	0.7	<u>+</u> 0.4
White Bass		0.2		-	0.2	0.2	<u>+</u> 0.2
Bluegill		0.1	0.1	-		0.1	<u>+</u> 0.1
Hybrid Sunfish*						0.1	<u>+</u> 0.1

<sup>\*</sup>No length categories established. Length categories can be found in Appendix A.

# **Walleye**

**Management objective:** Maintain a walleye population with a gill-net CPUE of at least 20, a PSD range of 30-60, and a growth rate of 14 inches by age-3.

Walleye CPUE in 2009 exceeded the ten-year average, but is still slightly below the management objective (Table 5). Sampled walleyes ranged in length from 11-58 cm (4.3-22.8 in) with a mean length of 284 mm (11.2 in) (Figure 1). Age-1 and age-2 fish comprised 93% of the 2009 sample and no age-3 walleyes were sampled (Table 6). Growth was within previously observed ranges and condition (Wr) was above the ten-year average (Table 5).

**Table 5.** Walleye gill-net CPUE, PSD, RSD-P, and mean Wr for Lake Madison, Lake County, 2000-2009.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Mean*
CPUE	12.2	24.7	16.2	9.0	8.0	10.7	14.3	17.3	5.8	16.8	15.5
PSD	5	27	71	85	67	6	23	25	93	15	41
RSD-P	0	0	4	56	25	2	4	0	7	2	10
Mean Wr	89	95	95	87	68	79	88	89	86	89	86

<sup>\*10</sup> years (1999-2008)

**Table 6.** Weighted mean length at capture (mm) for walleye captured in gill nets in Lake Madison, Lake County, 2003-2009. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size in parentheses.

Year	1	2	3	4	5	6	7	8	9	10	11	12
2009	240	324		506		548						
(97)	(45)	(49)		(1)		(2)						
2008	208		436		482							
(35)	(21)		(9)		(5)							
2007		360	376	457								
(43)		(32)	(3)	(8)								
2006	264	342	400			590				615		
(57)	(44)	(1)	(10)			(1)				(1)		
2005	257	306	337					620				
(64)	(1)	(49)	(13)					(1)				
2004	216		382	441	535	575						
(32)	(22)		(4)	(2)	(3)	(1)						
2003	307	403		516	522		556	614				
(27)	(3)	(6)		(6)	(9)		(2)	(1)				

Natural reproduction in 2009 created a moderate year class. The age-0 walleyes were large and similar to the size of fish from other moderate and weak year classes. Four age-0 walleyes were caught during the August lake survey gill nets, another indication of rapid growth. Age-1 walleye CPH was lower than anticipated based on the 2008 age-0 catch and the age-1 catch in this year's gill net sample. The age-1 walleyes were also large and in good condition.

**Table 7.** Age-0 and age-1 walleyes sampled during 2 hours of nighttime electrofishing on Lake Madison, Lake County, 1999-2009.

		Age-0	80%	%	Mean length		Age-1	80%	Mean length	
Year	Stocking	CPH	C.I.	stocked	(range; mm)	Wr	CPH	C.I.	(range; mm)	Wr
2009	none	27	14-40		199 (140-222)	105	8	2-14	307 (292-319)	94
2008	fingerling	347	200-495	2	145 (119-183)	95	19	15-23	251 (216-281)	83
2007	fingerling	378	210-493	81 <sup>1</sup>	150 (109-196)	87	0			
2006	none	4	1-7		199 (185-210)	109	10	6-14	309 (289-333)	101
2005	fingerling	128	82-174	100	158 (126-227)	90	0			
2004	none	2	0-4		163 (150-178)	102	30	21-39	244 (201-288)	80
2003	fingerling	293	186-400	100	154 (125-182)	87	2	1-3	312 (271-334)	86
2002	fry	12	7-17	90	209 (187-225)	110	4	0-8		<u>.</u>
2001	none	4	1-6		222 (214-231)	106	0			<u>.</u>
2000	none	15	6-24		190 (165-214)	98	58	31-85	267 (230-302)	83
1999	fry	166								

<sup>&</sup>lt;sup>1</sup> Fingerlings marks (Madison stocking) were present on 71% of samples and fry marks (Herman stocking) were present on 10% of samples.

### Yellow Perch

**Management objective:** Maintain a yellow perch population with a gill-net CPUE of at least 50 and a PSD range of 30-60.

Yellow perch gill-net CPUE decreased to only 18.3 (Table 8), a surprise considering the large numbers of fish observed during spring 2009 spawning operations. Perch sampled in 2009 ranged from 150-280 mm (5.9-11.0 in) with a mean length of 225 mm (8.9 in) (Figure 2). Yellow perch grow fast in Lake Madison (Table 9), however, they are typically short lived with only a small percentage living longer than four years (Table 9).

Lake Madison was used as a source of perch eggs for our hatchery stocking programs in 2009. With a relatively small amount of effort, over 40 million yellow perch eggs were acquired from April 17, 2009 to May 1, 2009.

**Table 8.** Yellow perch gill-net CPUE, PSD, RSD-P, and mean Wr for Lake Madison, Lake County. 2000-2009.

		<u>, , , , , , , , , , , , , , , , , , , </u>									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Mean*
CPUE	131.3	67.3	378.8	261.3	72.3	30.7	17.5	115.3	101.3	18.3	126.6
PSD	36	40	2	60	85	94	49	10	25	89	47
RSD-P	15	18	0	0	8	47	19	5	3	11	15
Mean Wr	106	108	87	95	98	96	104	109	109	114	101

<sup>\*10</sup> years (1999-2008)

<sup>&</sup>lt;sup>2</sup> Stocked fingerlings were not marked in 2008; however, approximately a third of the Madison sample exhibited faint fry marks indicating contribution from Lake Herman stocked walleye fry.

**Table 9.** Weighted mean length at capture (mm) for yellow perch captured in gill nets in Lake Madison, Lake County, 2003-2009. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size in parentheses.

Year	1	2	3	4	5	6	7	8
2009	162	228	261				-	-
(110)	(8)	(98)	(4)					
2008	157	228	261	220				-
(609)	(450)	(103)	(50)	(6)				
2007	163	182	244			253		-
(403)	(113)	(268)	(16)			(6)		
2006	173	223	242		262			-
(68)	(34)	(10)	(7)		(17)			
2005	153	234	262	250	273			-
(185)	(11)	(44)	(7)	(118)	(5)			
2004	166		228					
(32)	(42)		(247)					
2003		200	212	199				
(27)		(586)	(179)	(19)				

Shaded area tracks the large 2001 year class. Notice the high mortality.

### Black Crappie

**Management objective:** Maintain a black crappie population with a trap net CPUE of at least 20 and a PSD of at least 40.

Black crappie trap-net CPUE decreased in 2009 (Table 10). However, midsummer trap net samples may not reflect the true abundance of black crappies in Lake Madison. Many more black crappies were observed during winter commercial seining, spring perch spawning operations, and fall electrofishing. The size structure of the population is excellent (Figure 3) with a PSD of 97, and a mean length of 220 mm (8.7 in). Lengths ranged from 150 mm (5.9 in) to 250 mm (9.8 in). Condition (Wr) is excellent with values always over 100.

Growth is similar to regional, statewide and large lakes means (Table 11) and recruitment has become relatively consistent for a large lake population. Fish from each of the 2006-2008 year classes were sampled with age-2 fish being the most abundant. Age-0 black crappies were observed during fall electrofishing and from shore indicating that a good year class was produced in 2009.

**Table 10.** Black crappie trap-net CPUE, PSD, RSD-P, and mean Wr for Lake Madison, Lake County, 2000-2009.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Mean*
CPUE	2.3	1.6	10.0	18.7	47.5	31.5	8.9	14.2	18.0	3.3	15.3
PSD	43	21	11	32	61	92	15	49	54	97	42
RSD-P	17	14	5	6	5	7	11	25	8	12	11
Mean Wr	130	136	124	108	111	114	120	110	110	109	118

<sup>\*10</sup> years (1999-2008)

**Table 11.** Average back-calculated lengths (mm) for each age class of black crappie in Lake Madison, Lake County, 2009.

					Ва	ack-calcu	ılation A	ge		
Year Class	Age	N	1	2	3	4	5	6	7	8
2008	1	1	97							
2007	2	22	104	197						
2006	3	10	88	189	233					
All Classes		33	96	193	233					
Statewide M	1ean		93	183	221	252	275			
Region III M	1ean	•	93	185	225	259	284	•	•	•
LLI* Mean			90	192	241	272	299			

<sup>\*</sup>Large Lakes and Impoundments (>150 acres)

# **All Species**

Common carp CPUE was the lowest seen since 2001 (Table 12). Bluegill CPUE was also low. CPUE for other species remains within previously observed ranges. White bass were sampled for the first time in Lake Madison in 2009. The last time spottail shiners were sampled was in 1993.

**Table 12.** Gill-net (GN) and trap-net (TN) CPUE for all fish species sampled in Lake Madison, Lake County, 2000-2009.

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SPS (GN)										0.2
SPS (TN)										
COC (GN)	1.7	1.0	16.8	2.0	1.5	1.7	2.0	2.8	0.7	0.3
COC (TN)	14.6	3.3	29.0	12.2	28.0	4.8	6.1	12.5	5.0	3.2
WHS (GN)	4.0	8.3	16.4	56.3	26.8	22.5	6.8	8.5	12.2	18.0
WHS (TN)	5.9	16.4	41.4	11.8	9.4	74.2	1.5	0.7	1.2	0.7
BIB (GN)			1.2	4.7	14.3	3.8	5.0	0.5	2.2	0.2
BIB (TN)	10.4	5.3	5.3	7.9	8.2	7.5	20.5	7.2	6.1	11.1
BLB (GN)	7.0	2.0	16.8	19.0	3.0	0.7	8.0	4.5	2.0	2.7
BLB (TN)	28.3	11.4	601.1	34.5	10.2	5.4	3.0	53.5	8.9	5.5
YBH (GN)										
YBH (TN)		0.1	0.1							
CCF (GN)										
CCF (TN)				0.1	0.1	0.1		0.6	0.1	
NOP (GN)		0.3		0.3	8.0			0.3	8.0	0.2
NOP (TN)	0.1		1.5	1.4	0.7	0.1		0.1	0.3	1.2
WHB (GN)										
WHB (TN)										0.2
GSF (GN)								0.3		
GSF (TN)	1.3	1.2	0.6	2.1	0.1	0.2	1.0	0.9	0.6	
HYB (GN)										
HYB (TN)		0.6	0.6	1.0	0.2		0.5	0.3		0.1
BLG (GN)	0.3							0.3		
BLG (TN)	4.2	3.4	1.1	6.7	1.9	4.6	6.1	1.0	0.9	0.1
SMB (GN)							1.5	1.8		
SMB (TN)							2.1	1.6		
BLC (GN)				1.0	3.8	3.2	2.5	9.5	5.2	0.2
BLC (TN)	2.3	1.6	10.0	18.7	47.5	31.5	8.9	14.2	18.0	3.3
YEP (GN)	131.3	67.3	378.8	261.3	72.3	30.7	17.5	115.3	101.3	18.3
YEP (TN)	15.0	60.9	184.0	149.3	5.4	1.2	0.4	8.5	32.2	1.5
WAE (GN)	20.0	24.7	16.2	9.0	8.0	10.7	14.3	17.3	5.8	16.8
WAE (TN)	9.1	1.8	0.5	1.3	3.0	1.0	2.1	1.0	2.4	1.7

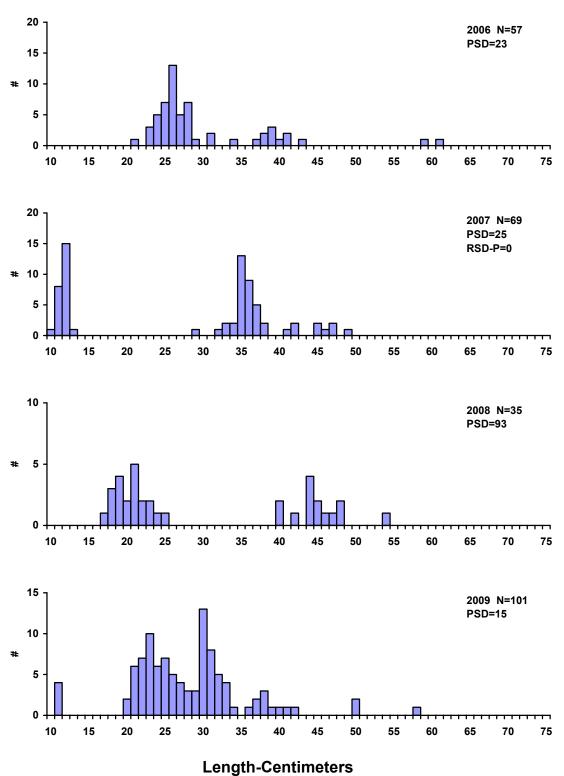
SPS (Spottail Shiner), COC (Common Carp), WHS (White Sucker), BIB (Bigmouth Buffalo), BLB (Black Bullhead), YBH (Yellow Bullhead), CCF (Channel Catfish), NOP (Northern Pike), WHB (White Bass), GSF (Green Sunfish), HYB (Hybrid Sunfish), BLG (Bluegill), SMB (Smallmouth Bass), BLC (Black Crappie), YEP (Yellow Perch), WAE (Walleye),

### **MANAGEMENT RECOMMENDATIONS**

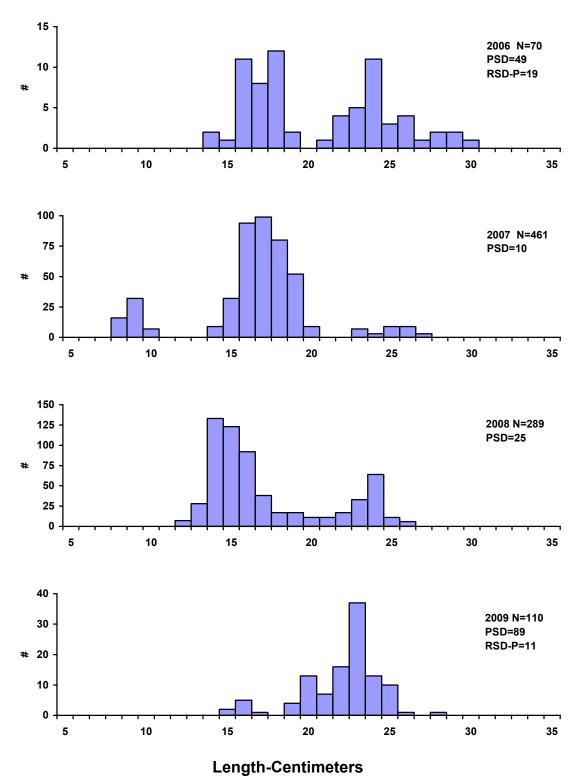
- Monitor the Lake Madison fishery by conducting annual netting and electrofishing surveys.
- 2. Accomplish our walleye management objective by stocking OTC-marked fry or fingerlings into voids of natural reproduction as determined by fall electrofishing results.
- 3. Continue efforts to develop a habitat management plan that incorporates artificial structures, fishing piers, rough fish management, and watershed management. Investigate the use of artificial structures to enhance spawning habitat and the use of barriers to protect panfish spawning areas from the destructive activities of common carp.
- 4. Consider using barriers to keep common carp away from their preferred spawning habitat to limit reproduction and control the carp population.
- 5. Encourage commercial fishing whenever rough fish abundance warrants it.

**Table 13.** Stocking record for Lake Madison, Lake County, 1995-2009.

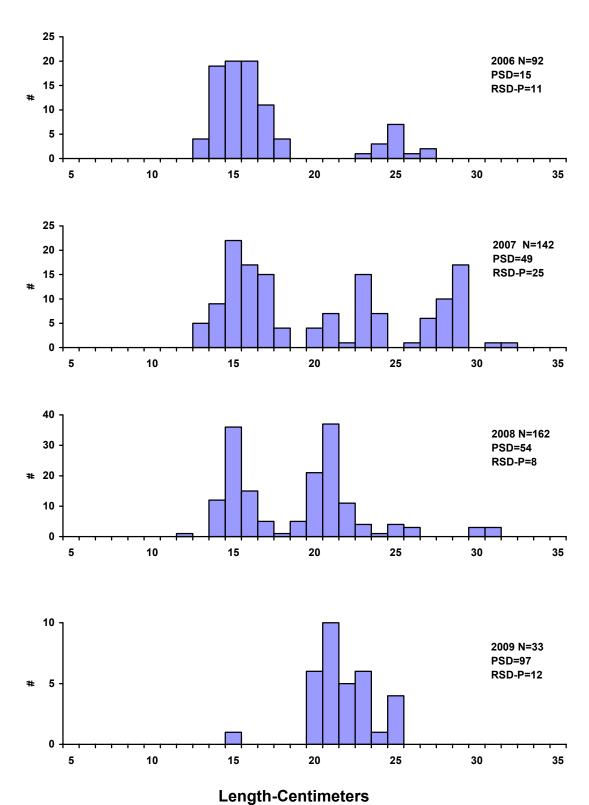
Year	Number	Species	Size
1995	192,700	Fathead Minnow	Adult
	11	Walleye	Adult
	501	Walleye	Lrg. Fingerling
	42,537	Yellow Perch	Adult
	141,725	Yellow Perch	Fingerling
1996	189,400	Bluegill	Fingerling
	561,800	Walleye	Sml. Fingerling
1997	2,800,000	Walleye	Fry
	27,980	Yellow Perch	Adult
1999	2,600,000	Walleye	Fry
	28,000	Yellow Perch	Adult
2002	2,500,000	Walleye	Fry
2003	280,680	Walleye	Sml. Fingerling
2005	264,200	Walleye	Sml. Fingerling
2007	264,440	Walleye	Sml. Fingerling
	187,000	Yellow Perch	Fingerling
2008	218,020	Walleye	Sml. Fingerling



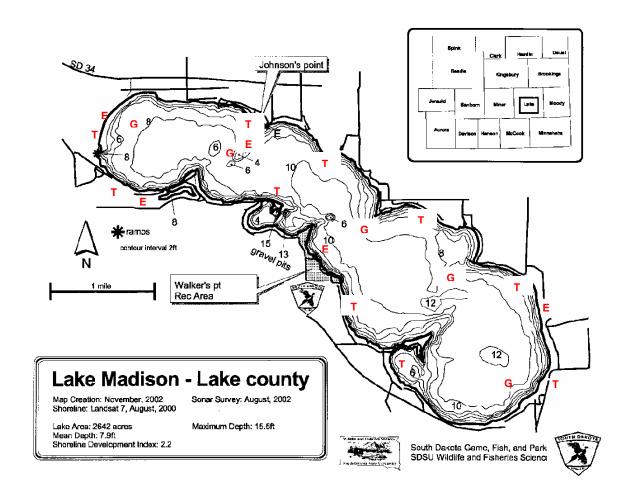
**Figure 1.** Length frequency histograms for walleye sampled with gill nets in Lake Madison, Lake County, 2006-2009.



Length-Centimeters
Figure 2. Length frequency histograms for yellow perch sampled with gill nets in Lake Madison, Lake County, 2006-2009.



Length-Centimeters
Figure 3. Length frequency histograms for black crappie sampled with trap nets in Lake Madison, Lake County, 2006-2009.



**<u>Legend</u>** Trap Net Sites: T

Gill Net Sites: G Electrofishing Sites: E

Figure 4. Sampling locations on Lake Madison, Lake County, 2009.

**Appendix A.** A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

**Catch Per Unit Effort (CPUE)** is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill-net nights of effort, catch per hour of electrofishing, etc.

Proportional Stock Density (PSD) is calculated by the following formula:

PSD = Number of fish > quality length x 100 Number of fish > stock length

**Relative Stock Density (RSD-P)** is calculated by the following formula:

RSD-P = Number of fish > preferred length x 100 Number of fish > stock length

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters.

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25	38	51	63	76
Sauger	20	30	38	51	63
Yellow perch	13	20	25	30	38
Black crappie	13	20	25	30	38
White crappie	13	20	25	30	38
Bluegill	8	15	20	25	30
Largemouth bass	20	30	38	51	63
Smallmouth bass	18	28	35	43	51
Northern pike	35	53	71	86	112
Channel catfish	28	41	61	71	91
Black bullhead	15	23	30	38	46
Common carp	28	41	53	66	84
Bigmouth buffalo	28	41	53	66	84
Smallmouth buffalo	28	41	53	66	84

For most fish, 30-60 or 40-70 are typical objective ranges for "balanced" populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

**Relative weight (Wr)** is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.